

WHAT IS CLAIMED IS:

1. A moveable lock ring apparatus for use in an injection mold, the lock ring apparatus comprising:

an inner sidewall surface including an area for sealing and aligning with a complementary surface on a mold core; and

an upper surface including an area for sealing and aligning with a complementary surface on a neck ring, and having a lifting surface for lifting a lower portion of a molded article,

said lock ring being configured for lifting a preform from the mold core during a first lifting operation, and configured to separate from the neck ring during a second lifting operation.

2. The moveable lock ring apparatus of Claim 1, wherein said lifting surface contacts substantially 50% of a sealing surface of said lower portion of the molded article.

3. The moveable lock ring apparatus of Claim 1, further comprising a first lifting structure configured to move said lock ring and neck ring a first distance in a lifting direction, and a second lifting structure configured to allow said lock ring to remain stationary and to move said neck ring a second distance in the lifting direction from said lock ring.

4. The moveable lock ring apparatus of Claim 1, wherein said first distance is different from said second distance.

5. An ejection apparatus for use in an injection mold, said ejection apparatus comprising:

a lock ring including an inner surface with an area for sealing and aligning with a complementary surface on a core, and an upper surface with an area for sealing and aligning with a complementary surface on a neck ring, said upper surface including a lifting structure for lifting a portion of a molded article; and

a neck ring including a contoured inner surface, wherein said neck ring comprises at least two neck ring portions,

said lock ring being configured for lifting a molded article from the core during a first lifting operation, and configured to separate from the neck ring during a second lifting operation by the neck ring.

6. The ejection apparatus of Claim 5, wherein said contoured inner surface of said neck ring engages corresponding contoured features of the said molded article.

7. An ejection apparatus for use in an injection mold, said ejection apparatus comprising:

a first lifting structure including an inner surface with an area for sealing and aligning with a complementary surface on a core, and an upper surface with an area for sealing and aligning with a complementary surface on a second lifting structure, said upper surface of said first lifting structure being configured to lift a molded plastic preform from the injection mold in a lifting direction for a first period of time, the lower portion of the molded plastic preform lying in a plane substantially perpendicular to the lifting direction; and

a second lifting structure including an inner surface configured to lift an outer surface of the molded plastic preform from the injection mold in the lifting direction for a second period of time, the outer surface of the molded plastic preform lying in a plane substantially parallel to the lifting direction.

8. The ejection apparatus according to Claim 7, wherein said lock ring lifts the molded plastic preform relative to a mold core for the first period of time, which is less than the second period of time.

9. The ejection apparatus according to Claim 8, wherein the molded plastic preform has a neck portion having a support ledge, threads, and a circular sealing surface, said circular sealing surface having a circular engagement portion lying in the plane substantially perpendicular to the lifting

direction, and wherein said lock ring is configured to engage substantially greater than fifty percent of the circular engagement portion.

10. The ejection apparatus according to Claim 9, wherein said neck ring has portions which respectively engage the molded plastic preform neck portion support ledge and the preform neck portion threads.

11. The ejection apparatus according to Claim 7, further comprising first moving structure configured to move said lock ring a first distance in the lifting direction, and a second moving structure configured to move said neck ring a second distance in the lifting direction, the second distance being different than the first distance.

12. The ejection apparatus according to Claim 7, wherein said neck ring applies a shear force to the molded plastic preform in the lifting direction, and wherein said lock ring applies a compressive force to the molded plastic preform in the lifting direction.

13. A preform ejecting apparatus provided in an injection mold, said preform ejecting apparatus comprising:

an injection mold core comprising structure complementary to an inner surface of a lock ring;

a lock ring including an inner surface structure for sealing and aligning with said core, and including an upper surface structure complementary to a lower surface on a neck ring, said upper surface structure including a lifting structure for lifting a portion of a molded article; and

a neck ring including a lower surface structure for sealing and aligning with said lock ring, and including a contoured inner surface,

said lock ring being configured to be translated with respect to the injection mold core during a first translation, and said neck ring being configured to be translated with respect to the lock ring during a second translation, thereby removing the molded article from the injection mold.

14. The preform ejecting apparatus of Claim 13, wherein said neck ring comprises at least two neck ring portions.

15. The preform ejecting apparatus of Claim 13, wherein said lock ring contacts a sealing surface of the molded article over at least 50% of said sealing surface.

16. An injection mold assembly comprising:  
a cavity insert provided in a cavity plate;

an injection mold core including structure complementary to an inner surface of a lock ring;

a lock ring including an inner surface structure for sealing and aligning with said core, and including an upper surface structure complementary to a lower surface on a neck ring, said upper surface structure including a lifting structure for lifting a portion of a molded article; and

a neck ring including a lower surface structure for sealing and aligning with said lock ring, said neck ring being mounted on movable slides;

a core plate;

an ejector plate; and

a stripper plate that supports said movable slides.

17. The injection mold assembly of Claim 16, further comprising a first actuating apparatus for equally displacing said ejector plate and stripper plate with respect to said core plate, while said core plate remains stationary, and

a second actuating apparatus for displacing said stripper plate with respect to said ejector plate.

18. The injection mold assembly of Claim 17, wherein the displacement of said ejection plate and said stripper plate causes said lock ring and said neck ring to be equally displaced relative to said core, and

wherein the displacement of the stripper plate with respect to the ejector plate causes said neck ring and said molded article to be displaced relative to said lock ring.

19. A method of ejecting a preform from an injection mold, comprising the steps of:

actuating at least one piston to separate an ejector plate and a stripper plate from a core plate, thereby separating an inner sidewall of a lock ring and an open end of a preform from a curved notch on the outer surface of a core, where said inner sidewall of said lock ring and said core are sealed and aligned during a molding operation;

actuating at least one connecting rod to separate said stripper plate from said ejector plate, thereby separating a neck ring and the preform from an upper surface of said lock ring, where a first portion of said upper surface of said lock ring is sealed and aligned with said neck ring during a molding operation, and wherein a second portion of said upper surface of said lock ring is a lifting surface for lifting the preform during the step of actuating said at least one piston.

20. A control apparatus for ejecting a preform from an injection mold, comprising:

at least one piston configured to move an ejector plate with respect to a core plate, causing an inner surface of a lock

ring sealed and aligned with respect to a mold core to be displaced relative to said mold core, while a lifting surface on an upper surface of the lock ring engages a lower surface of the preform, causing the preform to be displaced relative to said mold core;

at least one connecting rod configured to move a stripper plate with respect to said ejector plate, causing a lower surface of a neck ring sealed and aligned with respect to the lock ring to be displaced relative to said lock ring, while an inner surface of said neck ring engages a contoured surface of the preform, causing the preform to be further displaced relative to the mold core; and

a control assembly for regulating the actuation of the at least one piston and the at least one connecting rod, so as to eject the preform from the injection mold.

21. The control apparatus of Claim 20, wherein said piston and connecting rod are provided as a unified structure.

22. The control apparatus of Claim 20, wherein said piston and connecting rod are provided as separate structure.

23. The control apparatus of Claim 20, wherein said piston and connecting rod are powered by a power source selected

from the group consisting of electrical motors, pneumatic motors or cylinders, and hydraulic motors or cylinders.

24. An injection mold stack assembly comprising:  
a cavity insert;  
an injection mold core including structure complementary to an inner surface of a lock ring;  
a lock ring having an inner surface structure for sealing and aligning with said core, and having an upper surface structure complementary to a lower surface on a neck ring, said upper surface structure including a lifting structure for lifting a portion of a molded article; and  
a neck ring having a lower surface structure for sealing and aligning with said lock ring.